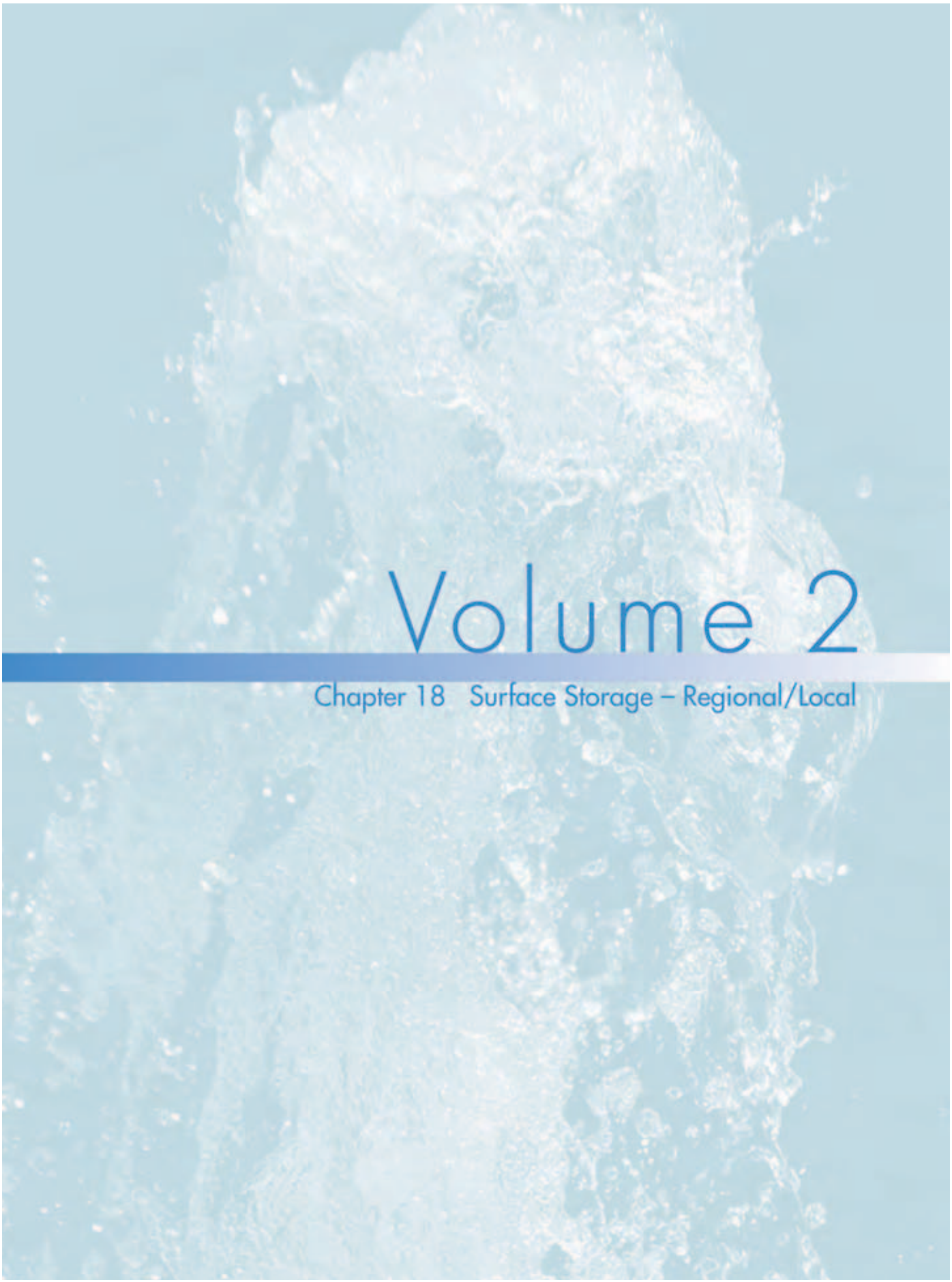

Volume 2

Chapter 18 Surface Storage – Regional/Local

Surface storage plays an important role in California where the pattern and timing of water use does not always match the natural runoff pattern. Contra Costa Water District pumps high quality water into its Los Vaqueros Reservoir and uses it to lower salt content of water it pumps from the Delta. (DWR photo)

Chapter 18 *Surface Storage – Regional/Local*

Surface storage is the use of reservoirs to collect water for later release and use. Surface storage has played an important role in California where the pattern and timing of water use does not always match the natural runoff pattern. Most California water agencies rely on surface storage as a part of their water systems. Similarly, surface storage is often necessary for, or can increase, benefits from other water management activities such as water transfers, conjunctive management and conveyance improvements. Some reservoirs contribute to water deliveries across several regions and some only contribute to water deliveries within the same watershed. Surface reservoirs can be formed by building dams across active streams or by building off-stream reservoirs where the majority of the water is diverted into storage from a nearby water source.

Surface storage capacity can also be developed by enlarging, reoperating (see the System Reoperation narrative) or modifying outlets on existing reservoirs. Smaller reservoirs typically store water in one season for use in another season, while larger reservoirs can do the same or store water for use over several years.

This strategy covers regional and local surface storage alternatives not currently under State and federal investigations as described in the CALFED Record of Decision. However, regional/local storage alternatives might include projects that are being investigated by CALFED but not ultimately implemented. They might also include storage alternatives that were eliminated at any juncture of the CALFED process since regional/local priorities and principles may be different than those used by CALFED. The potential CALFED surface storage projects are described in Chapter 17, Volume 2.

Surface Storage in California

California has nearly 200 surface storage reservoirs greater than 10,000 acre-feet with a combined storage capacity of more than 41 million acre-feet. In addition, many smaller reservoirs are used to provide for a wide range of water uses, stabilize water delivery to customers and provide a backup for emergency supply. Similar to many other parts of the world, most California reservoirs were developed over 30 years ago. As of the mid-1990s, there were about 1,242 dams being built worldwide – 55 in the United States[1]. In California, nearly 40 dams have been built over the past decade[2]. Examples of recently completed surface storage reservoirs completed by local/regional entities include: Olivenhain, Los Vaqueros, Diamond Valley and Seven Oaks reservoirs. The primary benefits of these new reservoirs are related to flood control (Seven Oaks), water quality, system flexibility, and system reliability against catastrophic events and droughts rather than for traditional water supply.

Over the past several decades, fisheries have received improved benefits from surface storage reservoirs through regulation and legislation. Specifically, many existing reservoirs have been managed to achieve ecosystem and other benefits beyond water supply. As water supplies dedicated to meeting both environmental and urban uses have grown, the state's surface water system has become increasingly inflexible. Water and ecosystem managers have less ability to adapt as use and regulatory requirements frequently control operations.

The relative need for local surface storage development may be greatest in the interior mountainous areas of the state such as the Cascades and the Sierra Nevada. Although much of the

[1] United States Society on Dams, November 2000

[2] Source: CA Division of Safety of Dams; includes DSOD jurisdictional dams only.

water used throughout the state originates in the mountains, these locations generally possess a much narrower array of available water management strategies to meet local needs. This is largely due to geographic, hydrogeologic or hydrologic limitations. Of these few strategies, some form of surface storage may hold the greatest potential for achieving local supply reliability objectives. Local surface storage development options include the reoperation of existing reservoirs, increasing the yield of existing reservoirs through expansion of their capacity, or construction of new reservoirs.

Potential Benefits of Surface Storage

Many of California's reservoirs were originally built for the primary purposes of hydropower, flood control, and consumptive water use. Although the allocation of benefits for proposed surface storage can affect the occurrence and magnitude of different types of benefits, they generally can include the following:

- Water quality management
- System operational flexibility
- Power generation
- Flood management
- Ecosystem management
- Sediment transport management
- Recreation
- Water supply augmentation
- Emergency water supply

The presence of new surface storage could allow ecosystem and water managers the flexibility to take actions and make real-time decisions that would not be possible without the storage. Water transfers between regions could be easier if water can be released from upstream storage at appropriate times and the receiving regions have reservoirs to store the transferred water. Surface storage can improve the effectiveness of conjunctive water management strategies by more effectively capturing runoff that can ultimately be stored in groundwater basins.

Storage projects can improve the movement of water at times to improve source water quality directly or facilitate blending of water from different sources to optimize system water quality. New surface storage can help provide water resources assets for the CALFED Environmental Water Account and Environmental Water Program, and for refuges. New surface storage can also help reduce the risk associated with potential future climate change by mitigating the effects of a relatively smaller seasonal snowpack storage capacity as well as increased or more sustained peak flood flows.

Potential Costs of Surface Storage

Cost estimates for potential surface storage alternatives are not specified in this narrative since they are only useful if created for a specific project with defined operation rules and allocation of benefits and costs. The costs of multipurpose storage projects will be shared by many beneficiaries. The magnitude of the benefits and corresponding costs for such things as water supply, water quality and flood management can be expected to vary significantly from project to project.

Major Issues Facing Surface Storage

Identifying Beneficiaries

There are concerns related to how the beneficiaries will be determined, who will actually pay, and who will control the storage operation. The challenge is to develop financial and operations agreements for the multiple beneficiaries and uses.

Funding

Construction usually requires a lot of money in a short time – perhaps $1 billion or more over five years for larger projects. Included in the long-term capital outlay are planning costs such as administrative, engineering, legal, financing, permitting and mitigation, which can also require significant investments. Some new storage options such as raising existing reservoirs, reoperating them or the construction of small local reservoirs may require significantly less capital, but may require local funding through revenue or general obligation bonds. Even these less costly projects could face financial challenges.

Impacts

New storage can affect environmental and human conditions, create economic impacts for the surrounding community, and flow impacts both up and downstream of diversions. New reservoirs may result in the loss of property tax revenue to local governments in the area they are located, or by increasing local property values by firming up a water supply. Regulatory and permitting requirements require surface storage investigations to consider potential impacts to stream flow regimes, potential adverse effects on designated wild and scenic rivers, potential water quality issues, potential changes in stream geomorphology, loss of fish and wildlife habitat, and risk of failure during seismic and operational events. Existing environmental laws require that these types of effects be mitigated. Mitigation of environmental effects is normally accomplished through implementation strategies that avoid, minimize, rectify, reduce over time, or compensate for negative impacts. New surface storage projects may need to address impacts

under the application of various laws, regulatory processes and statutes such as Public Trust Doctrine, State dam safety standards, Area of Origin statutes, California Environmental Quality Act, National Environmental Protection Act, the Clean Water Act and the Endangered Species Acts.

Suitable Sites

Most of the best reservoir sites have already been used and the new standards of environmental regulations are significant constraints to development of surface storage in the mountains. The range of surface storage development options for smaller local agencies is more limited than for the State and federal governments. Local agencies have limited ability to use State or federal funds, nor do they have the ability to work as closely with their corresponding resource regulatory agencies such as the State and federal agencies do as part of CALFED. Additionally, there are physical limitations on storage options in some parts of the state. In some areas, offstream storage is not feasible. These circumstances severely constrain the ability of local governments and agencies to finance and implement the projects necessary to sustain the local economy and serve increasing populations.

Science

Biologists and water managers continue to struggle to identify and understand the relationships between hydrodynamics, flow timing, water temperature, geomorphology, water quality, environmental responses, and other conveyance related considerations. Increased understanding of these considerations will enable resource planners and managers to better determine the causes of observed impacts and hence, more effectively restore, preserve and manage at-risk resources, such as modified operations and environmental mitigation.

Recommendations to Better Manage and Increase Surface Storage Benefits

1. Local agencies seeking to implement storage projects should develop a comprehensive methodology for analyzing all benefits and full costs of projects. DWR should provide technical expertise and assistance to the local agencies if asked.
2. Reservoir operators and stakeholders should continue to adaptively manage operations of existing facilities in response to increased understanding of system complexities and demands as well as changes in natural and human considerations such as social values, hydrology, and climate change.
3. DWR and other local, State and federal resource management agencies should continue studies, research and dialogue focused on a common set of tools that would help determine the full range of benefits and impacts as well as the costs and complexities of surface storage projects.
4. Water resources scientists, engineers and planners, including DWR should recognize the potential long development time for new surface storage in securing funding needed for continuity of planning, environmental studies, permitting, design, construction, and operation and maintenance.